MASTERCLASS SERIES
in Systems Thinking

SYSTEMS THINKING FOR ECD

Complex System Behaviors that Can Help Us Plan and Evaluate

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4.669... Evaluation & Planning

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The Systems Thinking for Early Childhood Development (ECD) Initiative is a partnership between ECDAN and Harvard University and supported by Porticus.

ECDAN Early Childhood Development Action Network

HARVARD T.H. CHAN SCHOOL OF PUBLIC HEALTH

Plan

Brief overview of complexity	▪ Randomness and predictability ▪ Intellectual history
Some complex system behaviors that should matter to us	▪ Quick explanation ▪ Deeper explanation (if time and interest) ▪ Begin class exercise
How to evaluate complex system behavior	▪ We already know what to do ▪ It's a matter of data interpretation ▪ Continue class exercise
When (and when not) to apply complexity	▪ What is a "good enough" explanation? ▪ When is good enough good enough? ▪ Continue class exercise
Evaluating transformation	▪ Definition ▪ Model ▪ Continue class exercise

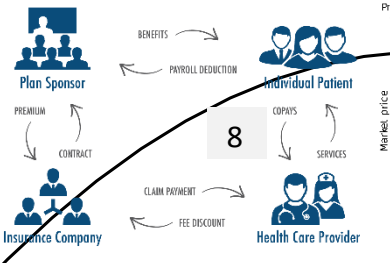
Where are Complexity Concepts Operative?

1

High

Complexity

Low



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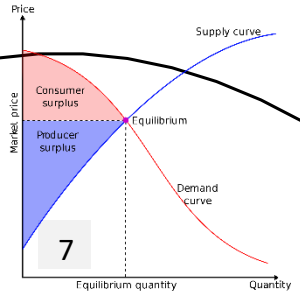

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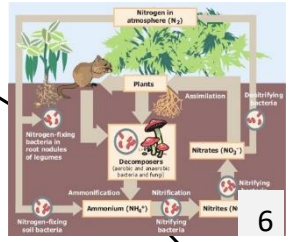

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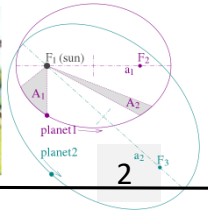

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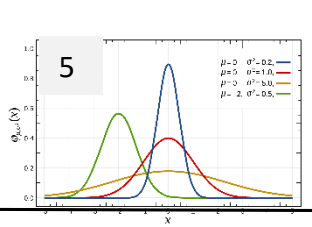

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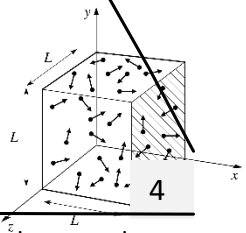


Low Random
High predictability

High Random
High predictability

1- Adapted from: David Krakauer What is Complexity?

2- https://en.wikipedia.org/wiki/Kepler%27s_laws_of_planetary_motion

3-http://barronberry.com/firm-news-and-events/celebrate-national-playground-safety-week-keep-your-kids-safe/

5- https://en.wikipedia.org/wiki/Normal_distribution

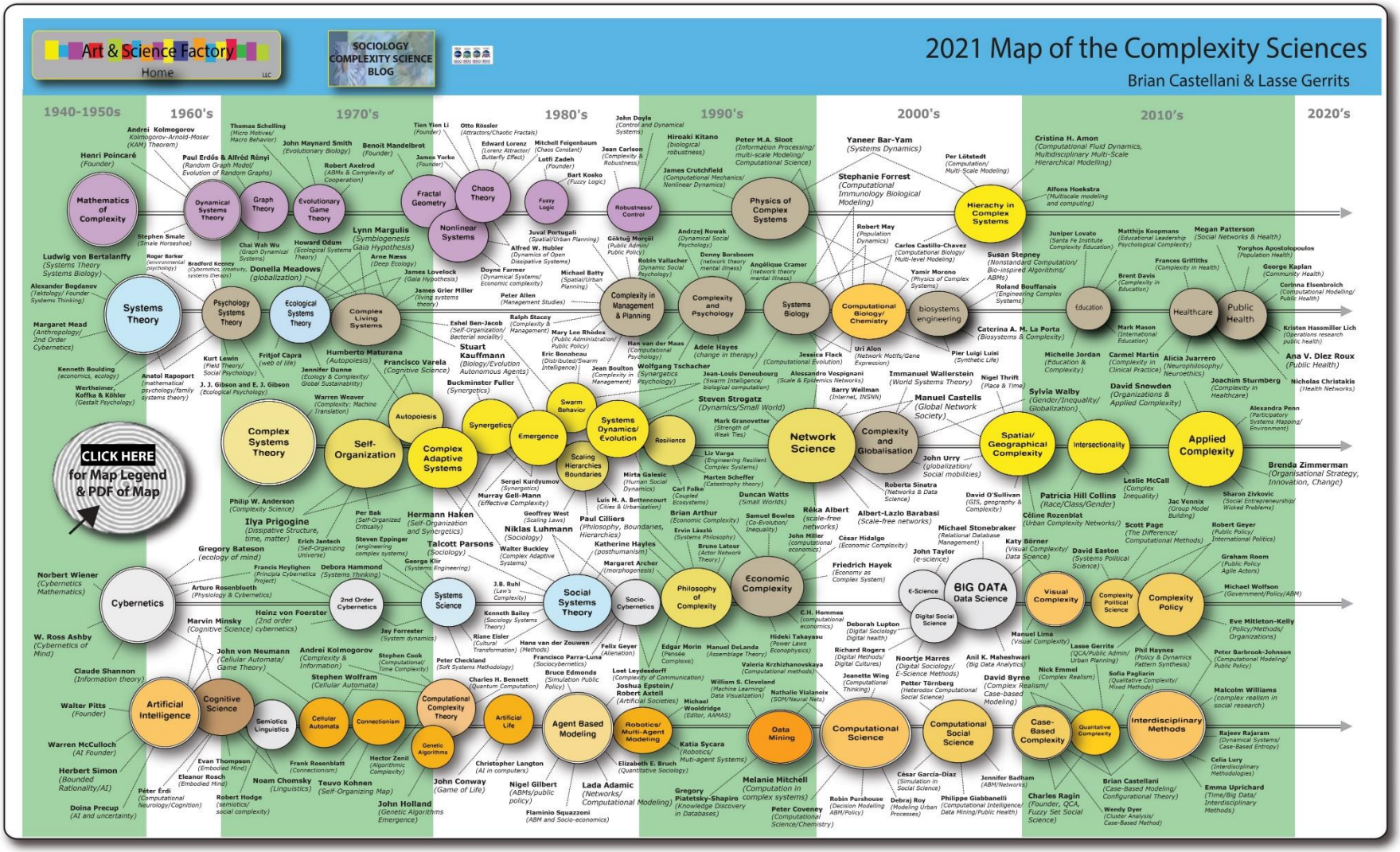
6- https://en.wikipedia.org/wiki/Ecosystem#/media/File:Nitrogen_Cycle.jpg

7- https://en.wikipedia.org/wiki/Wikipedia:WikiProject_Economics

8- https://axenehp.com/accountability-hospital-health-system-pricing/

4- https://socratic.org/questions/what-causes-gas-pressure-in-terms-of-kinetic-theory

Complexity: Historical View[1]



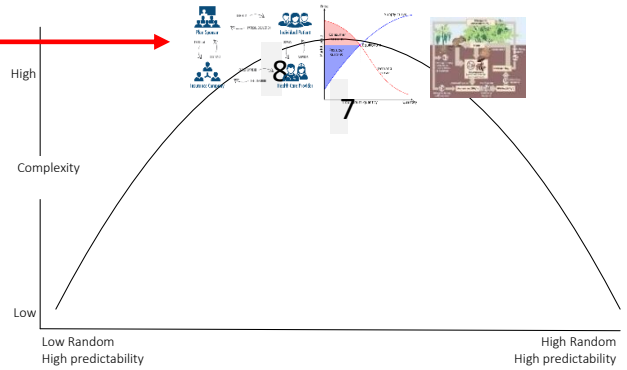
1- https://www.art-sciencefactory.com/complexity-map_feb09.html

Class Exercise

Be ready to discuss a planning or evaluation scenario you have with respect to the material that is presented in this master class.

Some Complex Behaviors that are Useful for Planning and Evaluation

I can't make practical decisions if I know a system is complex.



I can if I know how a complex system behaves.

Stigmergy	Pattern from independent agents following rules based on what is immediately before them.
Emergence	The whole is qualitatively different than the sum of its parts.
State Change	Sudden change from one set of social conditions to another
Sensitivity to conditions	Small changes can (but seldom do) change the trajectory of a system.
Attractors / Self organization	• A social system's "normal" / equilibrium to which it naturally gravitates. • Dynamics that drive attractor behavior.

Why Should We Care About Complex Behaviors? *

	Because it changes how we reason about how programs work and what they accomplish.		
	Pattern	Predictability	How Change Happens
Stigmergy			
Emergence			
State Change			
Sensitivity to conditions			
Attractors / Self organization			

Class Exercise

Please tell us about a planning or evaluation scenario where any of these complex behaviors are operating.

* Complexity Science has much else to teach us, but these are highly consequential to much of what we do.

Complex Behavior, Plebian Methodology

Methodologies

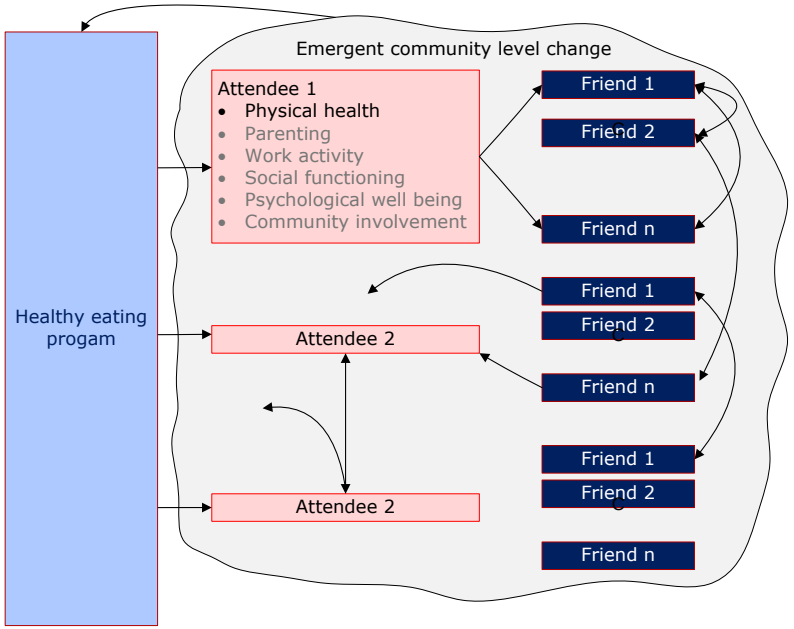
- Process tracing
- Outcome harvesting
- Contribution analysis
- Track change over time
- Program activity monitoring
- Content analysis of social media
- Compare with other communities
- Interviews (staff, attendees, others)
- Observation (program staff, attendees and others)

What to measure? Person / group view

- Influence on friends
- Programming change
- Community level changes
- New programs that appear
- Existing programs that disappear
- Immediate impact on participants
- Secondary impacts on participants

What to measure? Network view

- New edges that appear
- New nodes that appear
- Old nodes that disappear
- Edge connection patterns
- Exiting edges that disappear

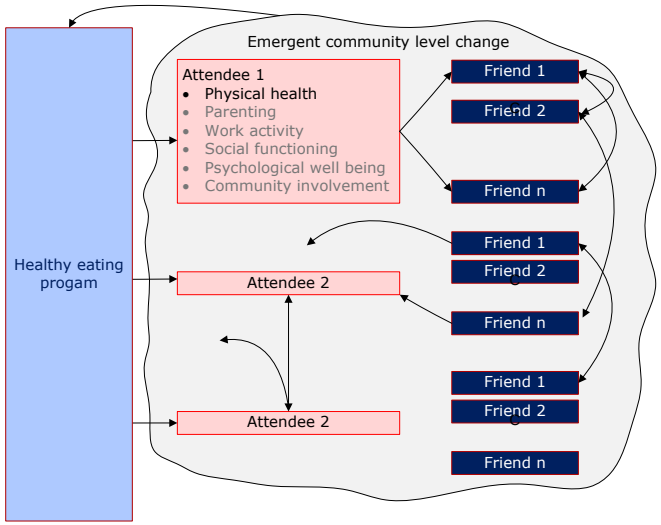


Data

- Records review
- Program activity monitoring
- Content analysis of social media
- Interviews (staff, attendees, others)
- Observation (staff, attendees, others)

Class Exercise

1. Sketch a complex system scenario that is relevant to your work.
2. Pick any of the categories below and identify some relevant elements in the list.



<u>What to measure? Person / group view</u>

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<u>Data</u>

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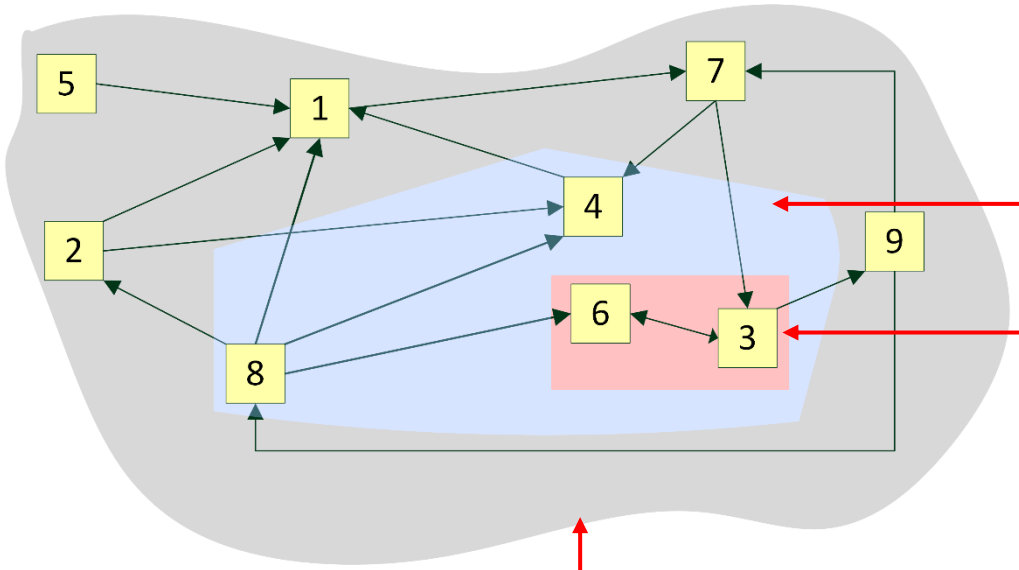
Sensitive Dependence Models have Decreasing Certainty as Range Expands.



Is it worth dealing with complexity?

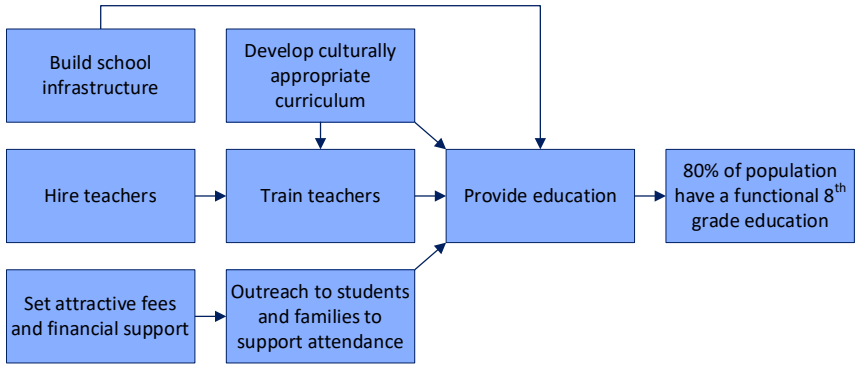
3, 6, 4, 8 Maybe

3 - 6 Probably not

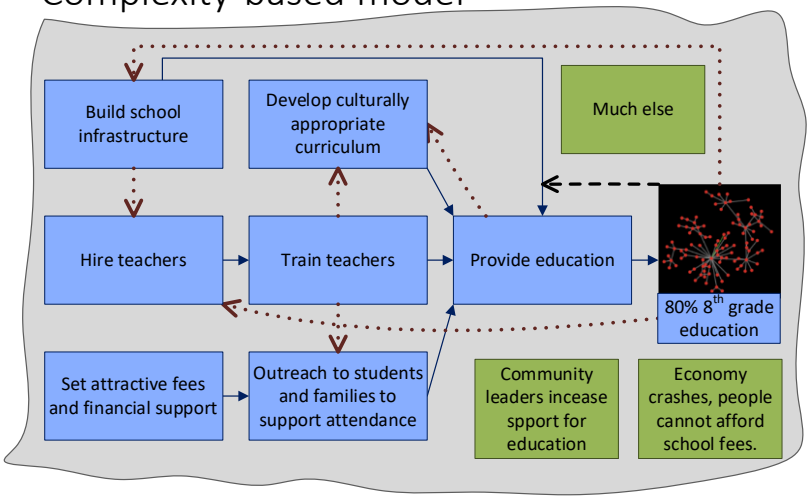
1, 2, 3, 4, 5, 6, 7, 8, 9 Yes

Does Invoking Complexity Always Make Sense? No.

Traditional if → then model



Complexity-based model



	Most Likely Answer			
	Traditional		Complex	
	Yes	No	Yes	No
Environment considered?				
Cost easily accommodated?				
Growth patterns recognized?				
Data requirements manageable?				
Easily understandable to stakeholders?				
Important elements and connections missing?				
High % of findings provide actionable information?				

Developing a Definition of Transformation

Transformation has occurred if

- in geopolitical boundary X (insert specifics)
- approximately 80 percent of [insert outcome of interest],
- Has maintained itself for about five years,
- The new state of affairs is generally accepted as the default condition.

No specific transformation	Insert for specific setting
Geopolitical boundary	Reasonable proxy for the combined effect of a multitude of factors.
Level of use	"80% -- reasonable approximation of a new equilibrium state.
Time	"About five years" – adequate to indicate that the change will endure.
Culture	"Generally accepted" – loose term that indicates social support.
Measurable but imprecise	"approximate," "about," "generally accepted." – • Avoid false precision. • Do not know enough to define transformation in specific terms. • Different combinations work, e.g. 95% but a smaller geographical area.
Agnostic	With respect to whether the change • is intended, • is unintended, or • A change unrelated to our action.

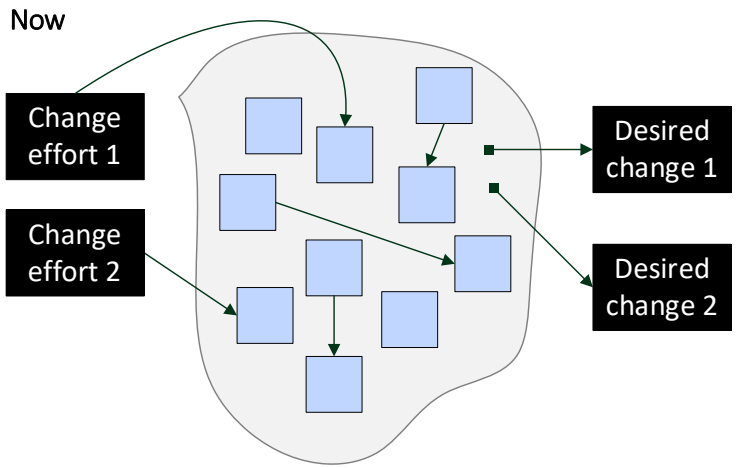
Exercise: Develop a Definition of Transformation For Your Setting

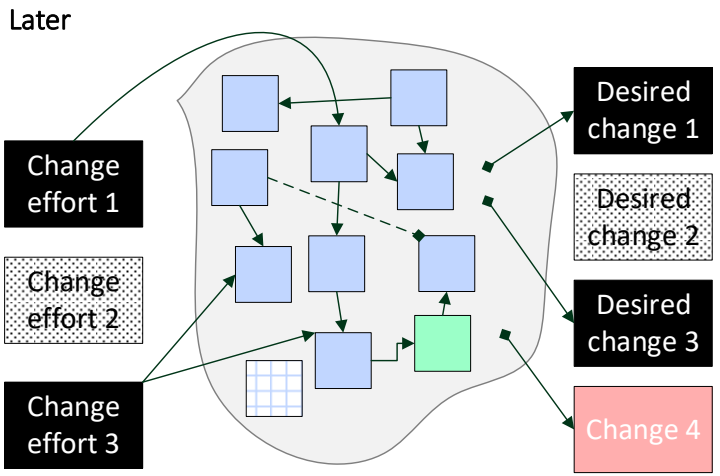
Transformation has occurred if

- in geopolitical boundary X (insert specifics)
- approximately 80 percent of [insert outcome of interest],
- Has maintained itself for about five years,
- The new state of affairs is generally accepted as the default condition.

		What ranges / types of variation would you accept?
What is your transformation?		
What geopolitical boundary would indicate transformation?		
What level of use would count as transformation?		
What timeframe would indicate transformation?		
What elements of "general acceptance" indicate transformation?		
What values underlie your belief that your transformation is desirable?		
What range on each of the above would you accept?		

What Does A Transformation Model Look Like and What Can We Know About Change?





Change efforts

- Multiple efforts going on.
- New initiatives will appear.
- Old initiative efforts will go away.
- Transformation initiatives have targets, e.g., tax policy, technology innovation.

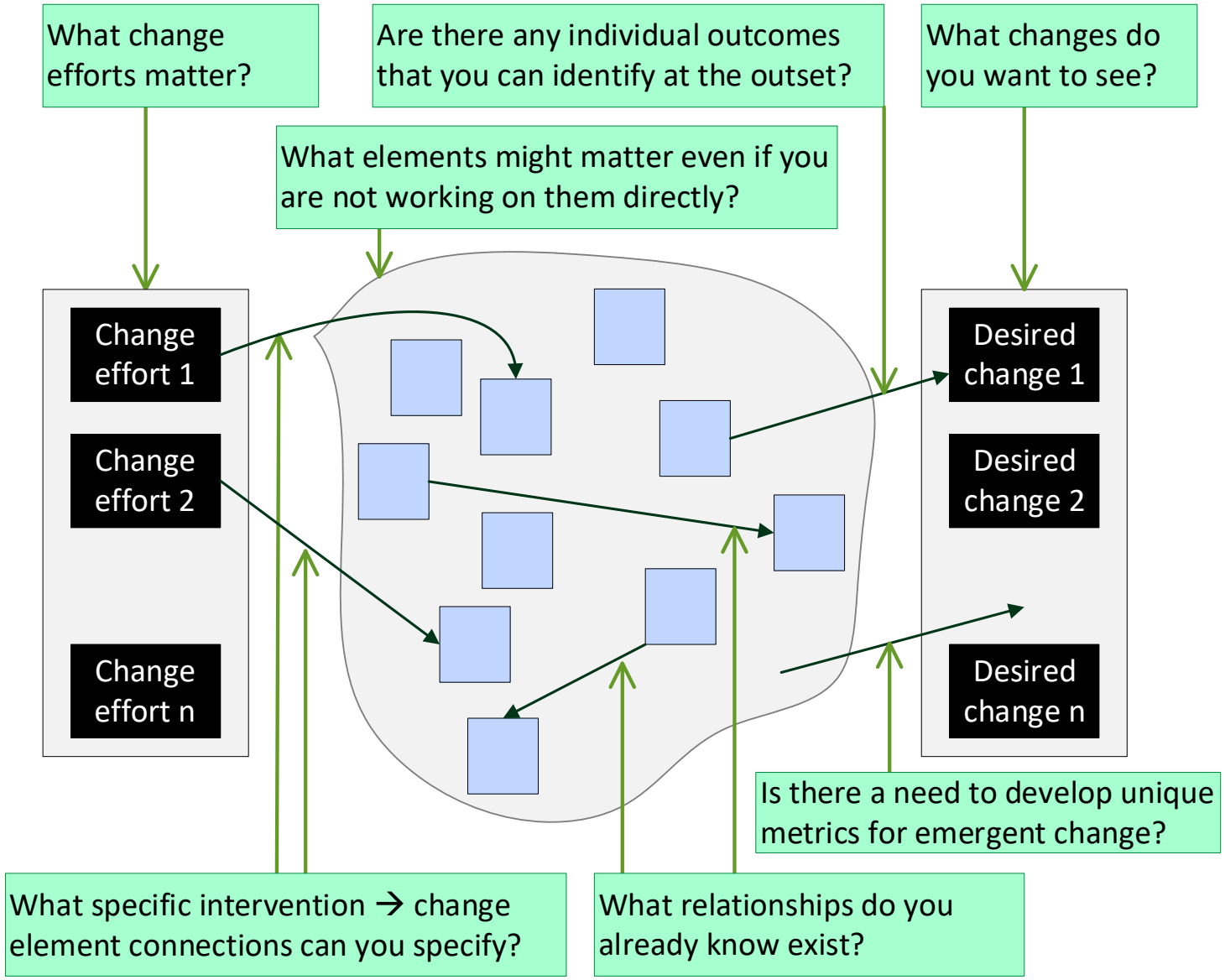
Process

- When changes happened.
- Which elements that are probably important.
- Networked relationships will develop over time.

Outcomes

- Unforeseen desirable changes will occur.
- What change happened and what did not.
- Foreseeable undesirable changes will occur.
- Unforeseen undesirable changes will occur.
- Overall emergent effects that will bring about change.

Exercise: Answer the Green Questions for a Transformation Scenario that You Care About



Emergence

Why it matters

- Tracing causal paths
- How change happens
- Worth measuring parts, but need different metrics for measuring the emergent phenomenon

Urban vitality *

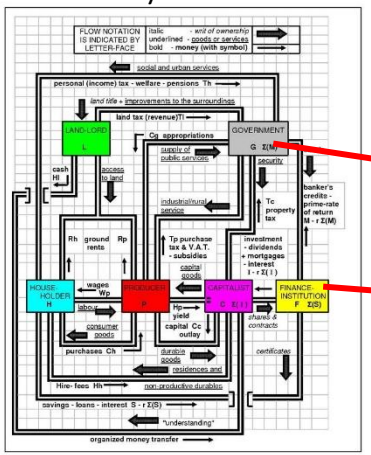
Parts

- parks
- walkability
- inspiration
- transportation
- ethnic diversity
- cultural choices
- etc.

Whole

- Real income

Economy ****



Parts

$$Y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \ldots + \beta_q x_q + \varepsilon$$

**

$$Y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \ldots + \beta_q x_q + \varepsilon$$

Whole

- GDP
- Inflation
- Home sales
- Unemployment rate
- Consumer spending
- Etc.

* https://www.alamy.com/stock-photo-east-indian-stores-in-the-jackson-heights-neighborhood-in-queens-in-121589536.html

** https://app.myeducator.com/reader/web/1421a/6/ye1ay/

*** https://devopedia.org/linear-regression

**** https://en.wikipedia.org/wiki/Economic_system

State Change

Why it matters

- Program theory
- How change happens
- Shape of change trajectory
- Realistic expectations about level of change over time

Some examples

- Democratic → Republican shift in US Southern States after the 1964 Civil Rights Act.
- E-Commerce after low costs in computing power, storage, and Internet connectivity came together
- “Me-to” as a social movement and cultural phenomenon.

Stigmergy

Why it matters

- Mechanism of coordination
- Explanation of change patterns and program effects
- Framework for inquiry when evaluating planned x unplanned change

Some examples

- Style in art
- Social norms
- Online communities
- Open-source software
- Intellectual trends in science

Related concepts

Self-organization	Pattern at the global level emerges solely from interactions among lower-level components. Rules specifying interactions are executed using local information. No control from the outside.**
Preferential attachment	Some quantity is distributed according to how much an entity already has. (e.g. citations, wealth, reputation, snowflake shape.

** Adapted from: Glossary at the Santa Fe Institute's Complexity Explorer

*** https://en.wikipedia.org/wiki/Preferential_attachment

Sensitive Dendence

Why it matters

- Consequences for predictability.
- Slight changes to starting conditions will lead to significantly different conditions in the future.*

Examples

Florida 2000 and the Butterfly Effect **

The evidence is strong that, all else being equal, Al Gore would have won if not for an infamous ballot design in Palm Beach County.

A few 100 ballots +
one district +
format of ballot =
outcome of presidential election

Richard III

For want of a nail, a shoe was lost.
For want of a shoe, a horse was lost.
For want of a horse, a soldier was lost.
For want of a soldier, a battle was lost.
For want of a battle, a war was lost.
For want of a war, a kingdom was lost.
All for the want of a nail.

** https://www.nytimes.com/2024/03/30/upshot/florida-2000-gore-ballot.html?smid=nytcore-ios-share&referringSource=articleShare

* Adapted from: Glossary at the Santa Fe Institute's Complexity Explorer

Social Attractor

Why it matters

- predictability
- how change happens
- resistance to change
- sustainability of change

Some evaluation questions about the attractor space

- What is the range of stable values?
- What is the range of values needed to effect change?
- What other types of programs, pursuing other outcomes, have the same attractor shape?

Related concepts

- Self-organization.
- Sensitive dependence

Some Source Material

YouTube
Part 1 -- Drawing on Complexity to do Hands-on Evaluation: What is the Need for Complexity? 0:3:37

Funder Evaluator Dialogue on Complexity 1:04:32

Blog Post
Questions That Could Benefit from an Understanding of Complexity 300 words

Complexity in Evaluation: My Latest Thinking on What Matters 530 words

Workshop slides –
full day professional development session at the European Evaluation Society
A Different Way to Understand How Programs Work and What They Accomplish (46 slides)

Journal Article
A Complexity-based Plan for Evaluating Transformation Journal of Multidisciplinary Evaluation

This article presents a case for more rigorous application of Complexity Science in our efforts to evaluate activity that seeks to bring about transformative change. It builds on the work that is already going on in the evaluation community. Three constructs from Complexity Science are employed – sensitive dependence, emergence, and social attractors. The paper argues that if →then logic is recommended for small-scale change within transformation efforts, but that to evaluate transformation writ large, data from if →then evaluation must be embedded in, and interpreted in terms of, complex behavior. Methodologies for evaluating within this framework are presented. The argument is linked to a definition of transformation that is multidimensional, non-linear, and measurable. The paper is built around a generic model of transformational change and shows how that model can be customized for specific transformation scenarios. It also shows how evaluation with respect to complexity can be accomplished with methodologies that are well known and well-practiced in the Evaluation community.

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Evaluation and Planning

Jonathan (Jonny) Morell

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Go here for the slide deck of this presentation.